



Designation: C1858 – 17a (Reapproved 2021)

# Standard Practice for Design, Construction, and Material Requirements for Direct Hung Suspended T-bar Type Ceiling Systems Intended to Receive Gypsum Panel Products in Areas Subject to Earthquake Ground Motions<sup>1</sup>

This standard is issued under the fixed designation C1858; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers the installation requirements of direct hung suspended t-bar type ceiling systems intended to receive gypsum panel products constructed as flat, single level, surrounded on all sides by a wall, bulk head, or soffit braced to the building structure to resist the effects of earthquake ground motions.

1.2 Ceiling assembly shall not be intended to support live loads.

1.3 This standard addresses ceiling systems with dead loads up to 10 lbs/ft<sup>2</sup> (48.8 kg/m<sup>2</sup>).

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recom-*

*mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

A641/A641M Specification for Zinc-Coated (Galvanized) Carbon Steel Wire<sup>2</sup>

C11 Terminology Relating to Gypsum and Related Building Materials and Systems<sup>4</sup>

C645 Specification for Nonstructural Steel Framing Members<sup>4</sup>

C754 Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products<sup>4</sup>

C1177/C1177M Specification for Glass Mat Gypsum Substrate for Use as Sheathing<sup>4</sup>

C1396 Specification for Gypsum Board<sup>4</sup>

C1658/C1658M Specification for Glass Mat Gypsum Panels<sup>4</sup>

E3090/E3090M Test Methods for Strength Properties of Metal Ceiling Suspension Systems<sup>3</sup>

## 3. Terminology

3.1 *Definitions*—Terms shall be as defined in Terminology C11.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *counter sloping wire, n*—opposing suspension wire intended to counteract the force of an out of plumb suspension wire and maintain alignment of the system.

3.2.2 *cross runner, n*—the secondary support members or cross beams of a mechanical ceiling suspension system transferring ceiling load to the main runner.

3.2.3 *diaphragm, n*—horizontal system acting to transmit lateral forces to the vertical resisting elements.

3.2.4 *direct hung ceiling, n*—load carrying ceiling components that are fastened directly to structure.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee C11.03 on Specifications for the Application of Gypsum and Other Products in Assemblies.

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<sup>2</sup> Annual ASTM Book of Standards, Vol.01.06.

<sup>4</sup> Annual ASTM Book of Standards, Vol.04.01.

<sup>3</sup> Annual ASTM Book of Standards, Vol.04.06.



3.2.5 *main runner, n*—the primary or main beams (supports) of the ceiling suspension system.

3.2.6 *t-bar ceiling, n*—modular interlocking suspended ceiling system containing framing members with inverted T-shaped profiles.

#### 4. Summary of Practice

4.1 This practice outlines the design and installation requirements of direct hung gypsum t-bar ceilings exempt from lateral bracing in areas subject to seismic activity.

#### 5. Significance and Use

5.1 This practice provides a standardized installation procedure for ceilings designed and installed as a diaphragm. When installed according to this practice, these ceilings have sufficient strength to resist seismic forces without lateral force bracing.

#### 6. Materials

6.1 Gypsum panel product shall conform to the requirements of Specifications **C1177/C1177M**, **C1396**, and **C1658/C1658M**.

6.2 Hanger wire shall conform to the requirements of Specification **A641/A641M**.

6.2.1 For tributary ceiling areas not more than 16 ft<sup>2</sup> (1.5 m<sup>2</sup>) and less than 6 lb/ft<sup>2</sup> (2.7 kg/m<sup>2</sup>), a minimum No. 12-gauge (2.9 mm) galvanized, soft annealed, mild steel wire shall be used. For ceiling weights greater than 6 lb/ft<sup>2</sup> (2.7 kg/m<sup>2</sup>), but not more than 10 lb/ft<sup>2</sup> (4.6/m<sup>2</sup>), see Specification **C754** Table 6.

6.3 Grid members shall conform to the requirements of Specification **C645**.

#### 7. Installation

7.1 The installation method described in this practice is limited to flat, single level designs surrounded on all sides by a wall, bulkhead, or soffit braced to the building structure to resist potential seismic forces imposed by the ceiling.

##### 7.2 *Securing Hanger to Structure:*

7.2.1 Secure suspension wire to the building structure using hanger attachment device suitable to carry the tributary vertical load of the ceiling system.

7.2.2 Each suspension wire shall not hang more than one in six out of plumb unless a counter sloping wire or horizontal bracing is provided. See **Fig. 1** for allowable counter sloping methods.

7.2.3 Locate vertical suspension wires no more than 24 in. from the perimeter on all main runners.

7.2.4 Local kinks or bends shall not be made in hanger as a means of leveling main runners.

7.2.5 In installations where the hanger wires are wrapped through main runners, the wire loops shall be tightly wrapped

and sharply bent to prevent any vertical movement or rotation of the member within the loops. The wire shall be wrapped around itself a minimum of three full turns (360° each) within a 3-in [75 mm] length. For safety purposes, the bottom of the hanger wires shall either be cut close to the vertical portion of the wire or shall be bent upward parallel to the vertical portion of the hanger wire.

7.2.6 Hangers formed from galvanized sheet metal stock shall be suitable for suspending main runners from an existing structure provided that the hangers do not yield, twist or allow subsequent downward movement of the main runners due to imposed vertical ceiling loads.

##### 7.3 *Perimeter:*

7.3.1 Terminal ends of grid members at the perimeter shall be fastened to perimeter angle/channel on all surrounding walls with fasteners appropriate for the wall substrate.

7.3.2 Perimeter angle/channel shall provide a surface to accept screw attachment of the gypsum panel product.

7.3.3 Perimeter angle/channel shall be fastened into structural element of the perimeter.

##### 7.4 *Grid Members:*

7.4.1 Main Runner and Cross Runners shall be spaced to carry the vertical load without exceeding a deflection limit of L/240.

7.4.2 Manufacturer shall provide sufficient data through either calculations or testing to Specification **E3090/E3090M** to verify vertical load carrying design capacity of the grid members.

7.4.3 Vertical support hanger wire spaced greater than 3 in. (75 mm) from fire expansion relief cutouts shall be permitted if load performance has been evaluated at the greater distance.

7.4.4 Seismic separation joints are not required for suspended gypsum board grid systems designed within the scope of this standard

#### 8. Substantiation

8.1 All seismic installations not within the scope of this practice shall be subject to evaluation by a licensed engineer.

#### 9. Drawings and Specifications

9.1 The construction drawings shall clearly identify all ceiling components. When this standard is referenced in a drawing, this standard shall be considered part of the requirements of the drawing to the prescribed extent of such reference. Where differences occur between provisions of this standard and referenced code, the provisions of the code shall apply. Deviations or variation shall be shown or defined in detail.

#### 10. Keywords

10.1 earthquake; grid ceilings; gypsum board ceiling suspension; seismic; seismic restraint; suspended gypsum board ceiling; t-bar